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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Patent Application of: Kazuo Fukai et al.			
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Appln. No.:	10/804,632	Examiner:	Leonid M. Fastovsky
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Title: LOW-TEMPERATURE BURN PREVENTING ELECTRIC FLOOR HEATING SYSTEM, ELECTRIC FLOOR HEATING PANEL, FLOOR HEATING FLOOR MATERIAL, AND ELECTRIC FLOOR HEATING DEVICE

AMENDMENT

This is in response to the Office Action dated January 12, 2006 (Paper No. 20060105) in the above-identified patent application. This response is being timely filed by May 12, 2006 in view of the accompanying Petition for Extension of Time (one month). Please amend the application, without prejudice, as follows:

Amendments to and Listing of the Claims

Please amend claims 1, 4, 9 and 12, so that the claims read as follows:

1. (Currently Amended) An electric floor heating system capable of preventing low-temperature burn; wherein said system comprises an electric floor heating panel and a floor material placed thereon; wherein said floor material is ~~formed by laminating integrally~~ an integral laminate of an upper material having a thickness (d) of from 0.01 to 12 mm and forming a floor surface, a heat diffusing material having a thickness (t) of from 30 to 1,000 μm and disposed below the upper material horizontally to the floor surface, and a lower material comprising a wood material having a thickness of 3 to 15 mm and whose lower surface contacts the panel; and wherein when said panel is selected from those whose minimum value (p1) of a maximum power is 65 W/m^2 and whose maximum value (p2) of the maximum power is any of (1) to (12) below, said upper material thickness (d) and said heat diffusing material thickness (t) ~~are set to~~ fulfill relational expression (I):

$$t \geqq a \times d^2 + b \qquad (I)$$

where ~~into which~~ coefficients a and b are predetermined by the maximum value (p2) of the maximum power ~~are introduced~~, such that said floor material is so constructed that, with the floor surface blocked by a human body and heated by said panel, a ~~temperature of the~~ floor surface-contacting portion of the human body is kept at a temperature of 42 ℃ or below:

(1) when p2 is 140 W/m^2, a is 2.1 and b is 50;
(2) when p2 is 150 W/m^2, a is 2.9 and b is 71;
(3) when p2 is 160 W/m^2, a is 4.5 and b is 113;
(4) when p2 is 170 W/m^2, a is 7.6 and b is 163;
(5) when p2 is 180 W/m^2, a is 17.9 and b is 228;
(6) when p2 is 230 W/m^2, a is 69.4 and b is 553;
(7) when p2 is 240 W/m^2, a is 79.7 and b is 618;
(8) when p2 is 250 W/m^2, a is 90.0 and b is 683;
(9) when p2 is 260 W/m^2, a is 100.3 and b is 748;
(10) when p2 is 270 W/m^2, a is 110.6 and b is 813;
(11) when p2 is 280 W/m^2, a is 120.9 and b is 878; and
(12) when p2 is 290 W/m^2, a is 131.2 and b is 943.

2. (Previously Presented) The electric floor heating system according to claim 1 wherein said heat diffusing material comprises aluminum.

3. (Previously Presented) The electric floor heating system according to claim 1 wherein a total thickness of said floor material is from 4 to 40 mm.

4. (Currently Amended) A panel for an electric floor heating system, comprising ~~formed by connecting foldably~~ a predetermined number of electric heating boards foldably connected to each other, wherein said panel is so designed as to cover ~~60~~ 50 to 70 percent of a room where said panel is to be installed; a minimum value (p1) of a maximum power of said panel is 65 W/m^2 and a maximum value (p2) of the maximum power of said panel is limited depending on a floor material combined therewith; wherein said floor material is ~~formed by laminating integrally~~ an integral laminate of an upper material having a thickness (d) of from 0.01 to 12 mm and forming a floor surface, a heat diffusing material having a thickness (t) of from 30 to 1,000 μm and disposed below said upper material horizontally to the floor surface, and a lower material comprising a wood material having a thickness of 3 to 15 mm and disposed below said heat diffusing material; and when said upper material thickness (d) and said heat diffusing material thickness (t) fulfill any of the relationships (1) to (12) below, the maximum value (p2) of the maximum power is ~~determined~~ as follows:

(1) when $t \geqq 2.1 \times d^2+50$ is fulfilled, p2 is 140 W/m^2;
(2) when $t \geqq 2.9 \times d^2+71$ is fulfilled, p2 is 150 W/m^2;
(3) when $t \geqq 4.5 \times d^2+113$ is fulfilled, p2 is 160 W/m^2;
(4) when $t \geqq 7.6 \times d^2+163$ is fulfilled, p2 is 170 W/m^2;
(5) when $t \geqq 17.9 \times d^2+228$ is fulfilled, p2 is 180 W/m^2;
(6) when $t \geqq 69.4 \times d^2+553$ is fulfilled, p2 is 230 W/m^2;
(7) when $t \geqq 79.7 \times d^2+618$ is fulfilled, p2 is 240 W/m^2;
(8) when $t \geqq 90.0 \times d^2+683$ is fulfilled, p2 is 250 W/m^2;
(9) when $t \geqq 100.3 \times d^2+748$ is fulfilled, p2 is 260 W/m^2;
(10) when $t \geqq 110.6 \times d^2+813$ is fulfilled, p2 is 270 W/m^2;
(11) when $t \geqq 120.9 \times d^2+878$ is fulfilled, p2 is 280 W/m^2; and
(12) when $t \geqq 131.2 \times d^2+943$ is fulfilled, p2 is 290 W/m^2.

such that said floor material is so constructed that, with the floor surface blocked by a human body and heated by said panel, a floor surface-contacting portion of the human body is kept at a temperature of 42°C or below.

5. (Previously Presented) The panel for an electric floor heating system according to claim 4 wherein said predetermined number of electric heating boards are foldably connected to respective adjacent electric heating boards by putting connecting belts through through-openings provided on edge side portions of the electric heating boards.

6. (Previously Presented) The panel for an electric floor heating system according to claim 4 wherein a heating element of said electric heating board comprises a mesh-structured body formed by joining a non-conductive fiber and a conductive fiber at their intersections; electrodes joined on both sides of said conductive fiber; an anchor part having a roughness on its surface and disposed on said electrodes; a fiber-reinforced prepreg sheet laminated on said anchor part and having a through-opening for a lead wire; and a resin film laminated on said prepreg sheet and having a through-opening whose diameter is larger than said through-opening, formed into a molded body by a pressure-heating treatment, and said anchor part is molded on its portion corresponding to said through-opening of said prepreg sheet, with a resin.

7. (Previously Presented) The panel for an electric floor heating system according to claim 4 which is composed of 2 to 10 electric heating boards.

8. (Previously Presented) The panel for an electric floor heating system according to claim 4 wherein said heat diffusing material comprises aluminum.

9. (Currently Amended) A low-temperature burn preventing floor heating floor material, wherein said floor material ~~is formed by laminating integrally~~ comprises an integral laminate of an upper material having a thickness (d) of from 0.01 to 12 mm and forming a floor surface, a heat diffusing material having a thickness (t) of from 30 to 1,000 μm and disposed below said upper material horizontally to the floor surface, and a lower material comprising a wood material having a thickness of 3 to 15 mm and disposed below said heat diffusing material; wherein said floor material is ~~formed integrally~~ designed to be integral with a heating panel whose minimum value (p1) of a maximum power is 65 w/m^2 and whose maximum value (p2) of the maximum power is any of those in (1) to (12) below; and wherein said upper material thickness (d) and said heat diffusing material thickness (t) ~~are determined so as to~~ fulfill any of

the relationships (1) to (12) below corresponding to the maximum value (p2) of the maximum power:

(1) when p2 is 140 W/m^2, $t \geqq 2.1 \times d^2+50$;
(2) when p2 is 150 W/m^2, $t \geqq 2.9 \times d^2+71$;
(3) when p2 is 160 W/m^2, $t \geqq 4.5 \times d^2+113$;
(4) when p2 is 170 W/m^2, $t \geqq 7.6 \times d^2+163$;
(5) when p2 is 180 W/m^2, $t \geqq 17.9 \times d^2+228$;
(6) when p2 is 230 W/m^2, $t \geqq 69.4 \times d^2+553$;
(7) when p2 is 240 W/m^2, $t \geqq 79.7 \times d^2+618$;
(8) when p2 is 250 W/m^2, $t \geqq 90.0 \times d^2+683$;
(9) when p2 is 260 W/m^2, $t \geqq 100.3 \times d^2+748$;
(10) when p2 is 270 W/m^2, $t \geqq 110.6 \times d^2+813$;
(11) when p2 is 280 W/m^2, $t \geqq 120.9 \times d^2+878$; and
(12) when p2 is 290 W/m^2, $t \geqq 131.2 \times d^2+943$,

such that said floor material is so constructed that, with the floor surface blocked by a human body and heated by said panel, a floor surface-contacting portion of the human body is kept at a temperature of 42°C or below.

10. (Previously Presented) The floor heating floor material according to claim 9 wherein said heat diffusing material comprises aluminum.

11. (Previously Presented) The floor heating floor material according to claim 9 wherein a total thickness of said floor material is from 4 to 40 mm.

12. (Currently Amended) An electric floor heating device which is a combination of an electric floor heating panel ~~formed by connecting foldably~~ comprising a predetermined number of electric heating boards foldably connected to each other and a floor material, wherein a minimum value (p1) of a maximum power of said panel is 65 W/m^2 and a maximum value (p2) of the maximum power of said panel is limited depending on [[a]] the floor material combined therewith; wherein said floor material ~~is formed by laminating integrally~~ comprises an integral laminate of an upper material having a thickness (d) of from 0.01 to 12 mm and forming a floor surface, a heat diffusing material having a thickness (t) of from 30 to 1,000 μm and disposed below said upper material horizontally to the floor surface, and a lower material comprising a wood material having a thickness of 3 to 15 mm and disposed below said heat diffusing material;

and when said upper material thickness (d) and said heat diffusing material thickness (t) fulfill any of the relationships of (1) to (12) below, the maximum value (p2) of the maximum power is ~~determined~~ as follows:

(1) when $t \geqq 2.1 \times d^2+50$ is fulfilled, p2 is 140 W/m^2;
(2) when $t \geqq 2.9 \times d^2+71$ is fulfilled, p2 is 150 W/m^2;
(3) when $t \geqq 4.5 \times d^2+113$ is fulfilled, p2 is 160 W/m^2;
(4) when $t \geqq 7.6 \times d^2+163$ is fulfilled, p2 is 170 W/m^2;
(5) when $t \geqq 17.9 \times d^2+228$ is fulfilled, p2 is 180 W/m^2;
(6) when $t \geqq 69.4 \times d^2+553$ is fulfilled, p2 is 230 W/m^2;
(7) when $t \geqq 79.7 \times d^2+618$ is fulfilled, p2 is 240 W/m^2;
(8) when $t \geqq 90.0 \times d^2+683$ is fulfilled, p2 is 250 W/m^2;
(9) when $t \geqq 100.3 \times d^2+748$ is fulfilled, p2 is 260 W/m^2;
(10) when $t \geqq 110.6 \times d^2+813$ is fulfilled, p2 is 270 W/m^2;
(11) when $t \geqq 120.9 \times d^2+878$ is fulfilled, p2 is 280 W/m^2; and
(12) when $t \geqq 131.2 \times d^2+943$ is fulfilled, p2 is 290 W/m^2.

such that said floor material is so constructed that, with the floor surface blocked by a human body and heated by said panel, a floor surface-contacting portion of the human body is kept at a temperature of 42°C or below.

13. (Previously Presented) The electric floor heating device according to claim 12 wherein the total thickness of said floor material is from 4 to 40 mm.

14. (Previously Presented) The electric floor heating device according to claim 12 wherein a heating element of said electric heating board comprises a mesh-structured body formed by joining a non-conductive fiber and a conductive fiber at their intersections; electrodes joined on both sides of said conductive fiber; an anchor part having a roughness on its surface and disposed on said electrodes; a fiber-reinforced prepreg sheet laminated on said anchor part and having a through-opening for a lead wire; and a resin film laminated on said prepreg sheet and having a through-opening whose diameter is larger than said through-opening, formed into a molded body by a pressure-heating treatment, and said anchor part is molded on its portion corresponding to said through-opening of said prepreg sheet, with a resin.

15. (Previously Presented) The electric floor heating device according to claim 12 wherein said heat diffusing material comprises aluminum.

REMARKS

Claims 1-15 are presently pending in the application.

Independent claims 1, 4, 9 and 12 have been amended to clarify that it is the floor surface-contacting portion of the human body which is kept at a temperature of 42°C or below, when the floor surface is blocked by the human body and heated by the floor heating panel of the present invention. Thus, in review of the application and claims, it was noted that claim 1 was inadvertently written to state that it was the floor surface contacting the human body which was kept at 42°C or below. These amendments are supported in the specification at paragraphs [0011] (page 3, lines 14-23), [0013] (page 4, lines 18-20), [0015] (page 5, lines 10-13) and [0117] (page 26, lines 17-19), for example. These amendments are also supported by Fig. 3, which demonstrates how the temperature is determined by an Estimated Floor Contact Temperature Meter (EFCT Meter) 30 by sensing the temperature at a surface 32, which represents a portion of the human body, and the felt 33, which represents the clothing on the human body, by a thermometer 36 and thermocouple 34 (see, for example, paragraphs [0015] and [0115] of the present specification). Accordingly, no new matter has been added, and entry of these amendments is respectfully requested.

In addition, claim 4, line 3 has been amended to specify that 50 to 70 percent of a room is covered by the panel. This amendment is supported, for example, in paragraph [0038] (page 10, line 4) of the specification, so that no new matter has been added.

Finally, independent claims 1, 4, 9 and 12 have been amended in numerous places to change language which could possibly be construed as process or use steps to language which is more clearly structural in nature. For example, the phrase "formed by laminating integrally" has been changed to "an integral laminate," "formed by connecting foldably" has been changed to "foldably connected," and the word "determined" has been deleted before the listed relationships in each claim to make clear that the relationships are fulfilled as a structural feature of the claimed invention. Since these are merely language changes, they are fully supported by the original claims, and no new matter has been added. Accordingly, entry of the amendments is respectfully requested.

The Examiner has rejected claims 1-3 and 9-11 under 35 U.S.C. § 103(a) as being unpatentable over Japanese Published Patent Application No. 07-292943 of Motoharu in view of U.S. Patent 6,737,611 of Ek et al. ("Ek"). The Examiner contends that Motoharu discloses an electric floor heating system with an electric heater installed under the floor, an upper floor 6, a heat diffusion aluminum material 5 having a thickness of 0.135mm, a lower plywood floor 4 having a thickness of 10mm, and a floor temperature between 27 and 29°C, which is below 42°C. The Examiner acknowledges that Motoharu does not disclose the relationship between the thickness of the floor parts and the power in W/m^2, but argues that Ek discloses floor heating device materials having a power between $60W/m^2$ and $80W/m^2$. The Examiner concludes that it would have been obvious to one skilled in the art to modify Motoharu's invention to include a material having the W/m^2 as taught by Ek and to select the structure of different parts of the floor heating systems, as a choice that would have been determined by the user having a desired result in mind, since Motoharu is capable of so performing. This rejection is respectfully but strenuously traversed for the reasons set forth in detail below.

A salient feature of the present invention resides in providing a floor heating system, panel, material or device according to a particular structural relationship between the thickness (d) of the upper material, the thickness (t) of the heat diffusing material, and the maximum value (p2) of the maximum power of the heater. This structure is defined by a specific relational formula or series of relationships, which are set forth in the claims, such that low temperature burn of the human body is avoided. By the structure satisfying these relationships, a portion of the human body in contact with the floor surface when being heated, is maintained at a temperature of 42°C or below. Further, by using the specified relationships, an electric floor heating system is easily constructed by matching the thicknesses (t) and (d) with the maximum power value (p2) of the heater.

In the Examiner's response to Applicant's arguments in paragraph 5 at the bottom of page 3 of the Office Action, the Examiner states that a recitation of the intended use of the claimed invention must result in a structural difference of the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, and then it meets the claim.

As noted above, claims 1, 4, 9 and 12 have been amended to delete, wherever possible, language which could be considered to be process or intended use language and to phrase the claims in more structural form. Thus, contrary to the Examiner's argument, the relational expression (I) and the relationships recited in claims 1, 4, 9 and 12 are structural relationships and not merely recitations of intended use. That is, these relationships determine a range of structures of the floor heating system, panel, material or device in which the thickness (d) of the upper material, the thickness (t) of the heat diffusing material and the maximum power value (p2) of the maximum power of the heater are all interrelated. By fulfilling the relationships of these thicknesses and power value, a floor heating structure is obtained which achieves the specified advantage of maintaining the temperature of the portion of the human body contacting the floor surface, at a temperature of 42°C or below, in order to prevent low-temperature burn. Motoharu does not disclose these structural relationships and therefore is not capable of achieving the desired result.

Motoharu's system and the claimed invention are completely different from each other and cannot be simply compared. The Examiner contends that Motoharu has heat diffusion aluminum material 5 having a thickness of 0.135mm and a lower plywood 4 having a thickness of 10mm. However, as exemplified, for example, in Table 2 at page 26 of the present specification, even when setting the thicknesses of an upper material (d) and a lower material to 0.5mm and 12mm, respectively, and using the same maximum power ($180W/m^2$) for the panel, the resulting contacting temperatures of the human body varies from 41.3°C to 48.1°C when the thickness of the heat diffusion material varies from 0 to 0.4mm (400μm). Therefore, the disclosure of only the thickness 0.135mm for the heat diffusion material and 10mm for the lower material, as in Motoharu, would not make it possible for a person skilled in the art to achieve the claimed system, wherein the contact body temperature is maintained at 42°C or below.

Furthermore, as described in paragraph [0011] of Motoharu, the disclosed thicknesses are merely the values to explain elastic modulus in respect to thickness. Moreover, Motoharu's system is constructed using a flooring having a total thickness of 10mm (see Example in paragraph [0020] of Motoharu), so that Motoharu does not teach the claimed floor material at all.

While it is true that Motoharu's system has a floor temperature between 27 and 29°C, and this temperature range would maintain the body temperature in contact therewith below 42°C, which would prevent low-temperature burn, such a floor system is unsatisfactory, because it fails to provide a comfortably heated room. In any event, Motoharu does not teach or even suggest any specific manner to adjust the temperature of the contacting portion of the human body to 42°C or below to prevent a low-temperature burn, while maintaining the room at a temperature at which the person therein feels comfortable.

Ek discloses a device for floor heating, referred to as a heat mat, utilizing a phenomenon called "Positive Temperature Coefficient (PTC)" as described in the art. As shown in Fig. 2 of Ek, the heat mat comprises a thin, conductive thermoplastic mat 1, having an electrically conducting core 2 of a specific material composition. The heat mat is heated by application of current. As the temperature increases, the volume resistivity for the material also increases, whereby the resistance in the heat mat increases and in turn causes the power, and thus the temperature, to decrease, even though the applied voltage is constant. As a result, the heat mat of Ek is self-regulating for temperature suitable for floor heating by using a semicrystalline polymer for the core material. While the Examiner relies on Ek for disclosing floor heating device materials having a power between $60W/m^2$ and $80W/m^2$, such power merely indicates the properties of the material composition, i.e., the volume resistivity of the semicrystalline polymer vs. temperature (see Fig. 3).

Ek does not teach or suggest any relationship between the thicknesses of the floor parts and the power in W/m^2. In contrast, the presently claimed invention is characterized by a specific combination of a heater power with thicknesses of floor material components which fulfill certain relationships, in order to achieve a comfortable floor heating, without causing low-temperature burn to a person in contact with the floor material. Even if Ek and Motoharu are combined, the resulting combination still fails to teach or suggest the presently claimed invention, since neither reference teaches or suggests any of the relationships specified in the present claims. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

The Examiner also rejects claims 4-5, 7-8, 10, 12-13 and 15 under 35 U.S.C. § 103(a) as being unpatentable over Motoharu in view of U.S. Patent 6,776,222 of Seki et al. The Examiner contends that Motoharu discloses substantially the claimed invention, but acknowledges that Motoharu does not disclose a foldable heating panel and boards connected by belts. The Examiner contends that Seki teaches a foldable floor heating panel 10 composed of at least three heating boards 11. The Examiner concludes that it would have been obvious to one skilled in the art to modify Motoharu's invention to include a foldable floor heating panel as taught by Seki to ease floor heating system installation and provide belts through holes, as a design choice, because Applicant has not disclosed that the belts provide an advantage or solve a stated problem. This rejection is also respectfully but strenuously traversed for the reasons set forth below.

Seki has been fully discussed in responses to the two previous Office Actions, and those discussions are incorporated herein by reference. As stated there, Applicants acknowledge that foldable flooring panels as disclosed in Seki are known in the art. Applicants do not contend that such foldable panels are novel *per se*. Instead, it is the specific structural relationships which are set forth in the claims which render the presently claimed invention novel and unobvious. Such relationships are not disclosed in either Motoharu or Seki. Therefore, even if properly combined, the combination of Motoharu with Seki still fails to teach or suggest the presently claimed invention. Accordingly, reconsideration and withdrawal of this rejection are also respectfully requested.

In view of the above Remarks, it is submitted that the claims patentably distinguish over the prior art of record. Accordingly, reconsideration and withdrawal of the rejections and an early Notice of Allowance are respectfully requested.

Respectfully submitted,

Kazuo Fukai et al.

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Enclosure – Petition for Extension of Time (one month)